REMARKS

Upon entry of the foregoing Amendment, claims 1-17 and 22-35 will be pending in the Office Action, with claims 1, 9, 22, 30, 31, 32, and 34 being the independent claims. Applicants amend claims 1, 2, 9, 11, 16, and 22 and add claims 25-35 as new claims. Claims 18-21 are cancelled without prejudice to or disclaimer of the subject matter therein. These amendments and new claims do not include new matter and are fully supported by the specification, drawings, and claims as originally filed.

Claims 1-17

In the parent application, the examiner rejected claims 1 and 9 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,370,936 to Yamagishi et al. ("Yamagishi") or U.S. Patent No. 5,604,319 to Kohsaka et al. ("Kohsaka") in view of U.S. Patent No. 3,913,617 to van Laar et al. ("van Laar"). None of the references cited by the Examiner, alone or in combination, teaches or suggests all the features of independent claims 1 and 9.

Claim 1 is directed to a method of mixing a first stream of gas with a second stream of gas. It includes introducing a first stream of gas into a mixing chamber via a plurality of first stream passages flow coupled to the mixing chamber. It also includes directing a second stream of gas into the mixing chamber via at least one second stream passage flow coupled to a first end of the mixing chamber. A combined stream is formed from the first and second streams. The combined stream is discharged from the mixing chamber through a mixing chamber exit port. The method also includes at least one of the following characteristic factors: 1) directing the first and second streams of gas through the plurality of first stream passages and the second stream passage into the mixing chamber in a manner that the streams of gas are unobstructed

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as they enter the mixing chamber; 2) providing walls of the mixing chamber with an absence of structure extending into the mixing chamber; 3) introducing the first and second streams of gas from the plurality of first stream passages and the second stream passage into the mixing chamber with a substantially well-developed flow; and 4) introducing at least one of the first and second streams of gas, as an exhaust gas, into the mixing chamber from more than one entrance port.

Claim 9 is directed to an apparatus for mixing a first and a second stream of gas. It includes a first plurality of passages configured to direct the first stream of gas, and a mixing chamber having first and second ends. The mixing chamber is flow coupled to the first plurality of passages and configured to receive the second stream of gas at the first end. The mixing chamber has an exit port at the second end. The apparatus further includes at least one of the following characteristic factors: 1) wherein the first plurality of passages and the second stream passage attach to the mixing chamber in a manner that the first and second streams of gas are unobstructed as they enter the mixing chamber; 2) wherein the mixing chamber has an absence of structure extending into the mixing chamber; 3) wherein the first plurality of passages and the second stream passage are configured to introduce the first and second streams of gas into the mixing chamber with a substantially well-developed flow; and 4) wherein at least one of the first plurality of passages and the second stream passage is configured to introduce at least one of the first and second streams of gas, as an exhaust gas, into the mixing chamber from more than one entrance port.

Yamagishi discloses that a portion of an exhaust gas G flowing in an exhaust pipe 2 is sampled by a probe 3. This sample exhaust gas G is inserted into a diluting

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tunnel 4. A diluting air supply passage 5 is connected to the upstream end of the diluting tunnel 4 and supplies air A for diluting the sample exhaust gas. *See* Yamagishi, column 2, lines 32-40. A wall, having an orifice therethrough, separates the diluting tunnel 4 into two sections, and the sample exhaust gas and the air A are both introduced into the first section. Yamagishi, FIG. 1.

Kohsaka discloses that exhaust gas from an engine 1 is introduced into a dilution tunnel 3 via an exhaust pipe 2 (see Fig. 1), that air is drawn into the dilution tunnel 3 through an air filter 4, and that the diluted exhaust gas is then drawn through a venturi tube 6. See FIG. 1.

van Laar discloses a system for cooling a first gas with a second gas before it is introduced to a blast furnace. A first conduit 1 carries a hot-blast flow and a second conduit 2 carrying a cold air flow. A ring main 3 and a plurality of pipe bends 4 connect the second conduit 2 to the first conduit 1. van Laar, column 2, line 62-column 3, line 4. The ring main 3 and the pipe bends 4 of van Laar purport to reduce or eliminate damage due to thermal deformations caused by the great temperature differences between the hot-blast flow and the cold air flow. van Laar, column 1, lines 44-50.

Neither the combination of Yamagishi and van Laar nor the combination of Kohsaka and van Laar teaches or suggests all the features of independent claims 1 and 9. For example, each of the references fails to teach any system or method of mixing gases with all the claimed features including any of the characteristic factors recited in the claims. As set forth below, each of the characteristic factors independently overcomes the combinations of the cited references.

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Characteristic Factor 1

Claim 1 recites, among other things, "directing the first and second streams of gas through the plurality of first stream passages and the second stream passage into the mixing chamber in a manner that the streams of gas are unobstructed as they enter the mixing chamber." Claim 9 recites "the first plurality of passages and the second stream passage attach to the mixing chamber in a manner that the first and second streams of gas are unobstructed as they enter the mixing chamber." Support for these recitations may be found in the specification at least at paragraphs 20, 30, 39, the drawings, and original claim 22.

The combination of Yamagishi and van Laar does not teach or suggest the claimed method or apparatus, including either of these features. Yamagishi teaches that a probe 3 extends from inside the exhaust pipe 2 into the diluting tunnel 4. Yamagishi, column 2, lines 32-36, Fig. 1. To enter the diluting tunnel 4, air from the diluting air supply passage 5 must pass around the probe 3, as it extends into the pathway of the stream of air. Accordingly, the probe 3 obstructs the stream of air. Yamagishi, Fig. 1. Yamagishi, therefore, includes one of the very problems that the claimed present invention is designed to overcome, namely, the gas stream from one passage contacting the other passage. *See* Specification, paragraphs 20, 30, 39.

van Laar is relied upon for as asserted teaching of a manifold. van Laar teaches introducing cold-air through a cold-air carrying conduit 2 into a conduit 1 of a hot blast furnace. The air in conduit 2 enters and merges with the air in conduit 1. Combining the manifold of van Laar with the diluting tunnel 4 of Yamagishi would result in several

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probes 3 extending from a manifold into the diluting tunnel 4, thereby further obstructing the air flow into the diluting tunnel 4 from the diluting air supply passage 5.

Similar to Yamagishi, Kohsaka discloses an exhaust pipe 2 protruding into the dilution tunnel 3. See Kohsaka, FIG. 1. Accordingly, the combination of the manifold of van Laar with the dilution tunnel 3 of Kohsaka would result in several exhaust pipes extending from a manifold, thereby obstructing the air flow into the dilution tunnel 3 from the filter 4.

Accordingly, neither the combination of Yamagishi and van Laar nor the combination of Kohsaka and van Laar teaches or suggests the claimed invention, which includes directing first and second streams of gas into a mixing chamber such that the streams of gas are unobstructed as they enter the mixing chamber.

Characteristic Factor 2

Claim 1 recites, among other things, "providing walls of the mixing chamber with an absence of structure extending into the mixing chamber." Claim 9 recites a combination where "the mixing chamber has an absence of structure extending into the mixing chamber." Support for these recitations may be found in the specification at least at paragraphs 17, 20, and 40, the drawings, and original claim 22.

The combination of Yamagishi and van Laar does not teach or suggest the claimed method or apparatus including either of these features. Yamagishi teaches that a barrier having an orifice extends from the wall of the diluting tunnel 4, dividing the diluting tunnel into two separate sections. Yamagishi, Fig. 1. Furthermore, Yamagishi teaches that the probe 3 can extend through the wall, into the volume portion of the diluting tunnel 4. Yamagishi, column 2, lines 32-36, Fig. 1. van Laar does not cure the

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deficiency because van Laar is relied upon for an asserted teaching of a manifold that introduces air through one conduit 2 into another conduit 1. Combining the manifold of van Laar with the diluting tunnel 4 of Yamagishi would still result the diluting tunnel 4 having a barrier with an orifice extending from the wall of the diluting tunnel. Accordingly, the combination of Yamagishi and van Laar does not teach or suggest the claimed invention having an absence of structure extending into the chamber.

The combination of Kohsaka and van Laar also does not teach or suggest an absence of structure into the chamber, as recited in claim 1. Kohsaka discloses a venturi tube 6 with a throat portion 6a within the dilution tunnel 3 before the diluted exhaust gas is blown out of the system by the suction blower 7. See Kohsaka, FIG. 1. Thus, combining Kohsaka with the manifold of van Laar would result in a dilution tunnel 3 having a venturi tube 6 disposed therein. Accordingly, the combination of Kohsaka and van Laar does not teach or suggest an absence of structure extending into the chamber.

Characteristic Factor 3

Claim 1 recites "introducing the first and second streams of gas from the plurality of first stream passages and the second stream passage into the mixing chamber with a substantially well-developed flow." Claim 9 recites "the first plurality of passages and the second stream passage are configured to introduce the first and second streams of gas into the mixing chamber with a substantially well-developed flow." Support for these recitations may be found in the specification at least at paragraphs 17-19, 33, and the drawings. For example, paragraph 33 states that the second manifold 22 may be

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similar to the first manifold 12 as shown in FIGs. 1 and 2. Accordingly, support for this feature may be imputed to FIG. 4.

The combination of Yamagishi and van Laar does not teach or suggest either of these features. Yamagishi discloses a quick 90 degree turn on the probe 3, introducing the exhaust gas G into the diluting tunnel. Yamagishi, Fig. 1. van Laar also teaches that its manifold includes pipe bends 4 that comprise 90 degree bends each having a leg and an axial leg. *See* van Laar, column 3, lines 1-4, Fig. 1. As described in the Specification, a well-developed flow may arise in a long pipe if the flow is not subject to any protrusions, changes in cross-section, or other disturbances. Specification, paragraph 18. Neither of the quick turns in the prior art allow passages to introduce streams of gas into a mixing chamber with a substantially well-developed flow, as recited in the independent claims. Accordingly, the combination of Yamagishi and van Laar does not teach or suggest introducing any air flow into a mixing chamber with a substantially well-developed flow.

The combination of Kohsaka and van Laar also does not teach or suggest the claimed invention. Kohsaka does not teach or suggest introducing gas streams with well-developed flow because the quick 90 degree angle just before the end of the exhaust pipe 2 would disrupt and spoil any well-developed flow. Kohsaka, Fig. 1. For the reasons set forth above, van Laar does not teach or suggest introducing gas streams with well-developed flow. Accordingly, the combination of Kohsaka and van Laar does not teach or suggest introducing any air flow into a mixing chamber with a substantially well-developed flow.

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Characteristic Factor 4

Claim 1 recites "introducing at least one of the first and second streams of gas, as an exhaust gas, into the mixing chamber from more than one entrance port." Claim 9 recites "at least one of the first plurality of passages and the second stream passage is configured to introduce at least one of the first and second streams of gas, as an exhaust gas, into the mixing chamber from more than one entrance port." Support for these recitations may be found in the specification at least at paragraphs 16, 31, and the drawings.

The combination of Yamagishi and van Laar does not teach or suggest the claimed invention. Yamagishi teaches introducing the exhaust gas only through the probe 3, providing a single entrance for the exhaust gas into the diluting chamber 4. *See* Yamagishi, column 2, lines 32-36, Fig. 1. van Laar does not cure the deficiency. van Laar does not teach introducing an exhaust gas at all, but only shows introducing cold air into a hot air conduit. Accordingly, the combination of Yamagishi and van Laar does not teach or suggest introducing at least one of the first and second streams of gas, as an exhaust gas, into the mixing chamber from more than one entrance port.

Likewise, the combination of Kohsaka and van Laar does not teach or suggest the claimed invention. Kohsaka teaches introducing the exhaust gas only through the exhaust pipe 2. van Laar does not teach introducing an exhaust gas from one more than one entrance port for the reasons set forth above. Accordingly, the combination of Kohsaka and van Laar does not teach or suggest the claimed invention, including introducing the exhaust into the sampling device from more than one entrance port.

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The combinations of Yamagishi with van Laar and Kohsaka with van Laar do not teach or suggest a method or apparatus of mixing gas streams as claimed, including any of the four claimed characteristics recited in claims 1 and 9. Accordingly, claims 1 and 9 are allowable over any combinations of Yamagishi and van Laar and Kohsaka and van Laar. Applicants respectfully request that the Examiner allow these claims.

Claims 2-8 and 10-17 depend from and add additional features to independent claims 1 and 9. Accordingly, these claims are allowable for at least the reasons set forth above. Applicants respectfully request that the Examiner allow these claims.

Claims 22-24

Claim 22 recites a mixing chamber for mixing a first stream of gas with a second stream of gas. It includes an internal volume defined by a first end, a second end, and walls extending between the first and second ends. The second end has a gradually converging portion, with an absence of structure extending from the first end, from the second end, and from the walls into the internal volume. A first inlet opening is configured to receive the first stream of gas into the mixing chamber. The first inlet opening is located at the first end. A plurality of second inlet openings are configured to receive the second stream of gas into the mixing chamber. The plurality of second inlet openings are symmetrically positioned with respect to the first inlet opening. An exit opening is configured to discharge a combined stream of gas formed from the first and second streams of gas from the mixing chamber. The exit opening is located downstream of the gradually converging portion wherein the first inlet opening and the plurality of second inlet openings are situated in a manner that the first and second streams of gas are unobstructed as they enter the mixing chamber.

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The combinations of Yamagishi with van Laar and Kohsaka with van Laar do not teach or suggest all the features of claim 22. None of the cited references teaches or suggests any mixing chamber with all the recited features of claim 22. For example, none of the references teaches or suggests an absence of structure extending from the first end, from the second end, and from the walls into the internal volume. Instead, Yamagishi discloses a barrier having an orifice extends from the wall of the diluting tunnel 4, dividing the diluting tunnel into two separate chambers. Yamagishi, Fig. 1. van Laar does not cure the deficiency because van Laar is relied upon for the teaching of a manifold, and introduces air through one conduit 2 into another conduit 1. Combining the manifold of van Laar with the diluting tunnel 4 of Yamagishi would still result in a barrier having an orifice extending from the wall of the diluting tunnel 4. Moreover, such a barrier extending into a diluting tunnel from a wall does not render unpatentable a claim reciting a mixing chamber with all the features of claim 22, including an absence of structure extending from the first end, from the second end, and from the walls into the internal volume.

Likewise, the combination of Kohsaka and van Laar does not teach or suggest all the features recited in claim 22. For example, the combination of Kohsaka and van Laar does not teach or suggest a mixing chamber having all the features claimed, including an absence of structure extending from the first end, from the second end, and from the walls into the internal volume. Kohsaka discloses a venturi tube 6 with a throat portion 6a within the dilution tunnel 3 before the diluted exhaust gas is blown out of the system by the suction blower 7. See Kohsaka, FIG. 1. Thus, combining Kohsaka with the manifold of van Laar would result in a dilution tunnel 3 having a venturi tube 6

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disposed therein. van Laar does not cure the deficiency because van Laar is relied upon for the teaching of a manifold, and introduces air through one conduit 2 into another conduit 1. A claim reciting a mixing chamber with all the features of claim 22, including an absence of structure extending from the first end, from the second end, and from the walls into the internal volume is patentable over this combination.

Further, the cited combinations of references fail to teach or suggest any mixing chamber having all the features of claim 22, including a first inlet opening and the plurality of second inlet openings situated in a manner that the first and second streams of gas are unobstructed as they enter the mixing chamber. As stated above, combining the manifold of van Laar with the diluting tunnel 4 of Yamagishi would result in a large number of probes 3 extending from a manifold into the diluting tunnel 4, obstructing the air flow past the probes 3 into the dilution tunnel 4 from the diluting air supply passage 5. Likewise the combination of van Laar with the dilution tunnel 3 of Kohsaka would result in a large number of pipes 2 extending from a manifold into the dilution tunnel 3. Accordingly, the combinations of Yamagishi with van Laar and Kohsaka with van Laar does not render claim 22 unpatentable.

Claims 23 and 24 depend from and add additional features to independent claim 22. Accordingly, these claims are allowable for at least the reasons set forth above. Applicants respectfully request that the Examiner allow these claims.

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New Claims

New claims 25-29 depend from and add additional features to independent claims 1, 9, and 22. Accordingly, these claims are allowable for at least the reasons set forth above. New claims 30 and 31 are directed to a method of mixing a first stream of gas with a second stream of gas, and an apparatus for mixing a first and a second stream of gas, respectively. The claims recite the method and apparatus, with all the recited features, including an absence of structure extending into the chamber and a full-flow exhaust gas. New claims 32-35 are directed to a method and apparatus for emissions sampling. The claims recite the method and apparatus, with all the recited features, including well-developed flow streams. Accordingly, these claims are patentable over the combinations of Yamagishi with van Laar and Kohsaka with van Laar. Applicants respectfully request that the Examiner consider these claims and pass them to allowance.

Conclusion

If there is any fee due in connection with the filing of this Preliminary Amendment, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

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